NOAA

National Environmental Satellite, Data, and Information Service
(NESDIS)

Comprehensive Large Array-data Stewardship System (CLASS)

Quality Management Plan

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Review and Approval

Quality Management Plan Review History

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Section 1 - Introduction

1.1 Purpose

The purpose of this Quality Management Plan (QMP) is to establish the goals, processes, and responsibilities required to implement effective quality management functions for the NOAA/NESDIS Comprehensive Large Array-data Stewardship System (CLASS) project. Quality Management (QM) identifies both the underlying concepts on which the plan is based and the specific activities conducted to ensure that:

- The business solution activities, such as functional requirements, technical constraints, system development and maintenance activities are accomplished in accordance with the approved methodology, supporting standards and procedures, and
- The products and services produced conform to applicable CLASS project requirements.

1.2 Scope

This CLASS QM Plan applies to all system development and maintenance efforts in support of CLASS. This plan is intended for use by all CLASS personnel to understand and perform the quality activities applicable to their responsibilities.

Quality management encompasses traditional quality control and quality assurance activities as well as defined processes, phases, and milestones specific to the needs of CLASS. The QMP requires that the project identify quality activities for their currently planned work phase and related releases. This QMP provides the framework necessary to ensure a consistent approach to quality and quality management throughout the CLASS life cycle.

Quality management is the systematic monitoring of a project's work products, services, and processes to ensure they meet customer requirements and comply with applicable methods, standards, and procedures throughout the project life cycle. Quality management consists of the project management accountability for quality and the responsibilities and actions that determine and implement policies. Quality management includes obtaining the commitment of the organization, marshaling resources, and ensuring that quality objectives and processes are used and supported effectively.

Quality management for the project is planned along with other project tasks and initiatives. Implementation of and compliance with the QMP is the shared responsibility of all project personnel. Both project management and technical staff are thus integrated with and committed to the success of overall CLASS Quality Management.

1.3 Document Organization

This project quality management planning document is organized as follows:

- Section 1, Introduction, outlines the purpose and scope of quality activities and responsibilities, as well as the purpose, scope, organization, and relationship of this document to other pertinent documents.

- Section 2, Quality Management Responsibilities, explains the responsibilities for quality management on the CLASS Project.
- Section 3, Quality Management Approach, defines the QM approach to assure compliance with the key concepts of CLASS QM.
- Section 4, Quality Management Records and Reports, describes the records and reports prepared and maintained by the Quality Function.
- Appendix A, QM Schedule and Metrics, outlines the proposed QM schedule and metrics report template.
- Appendix B, Distribution of Quality Responsibilities, reflects the distribution of quality effort between the QMO and CLASS project personnel.
- Appendix C contains a glossary of definitions.
- Appendix D contains acronyms used in this document.

1.4 References and Related Documents

The CLASS Project Management Plan (PMP) is the primary document describing the management processes and strategies for the overall CLASS Project. The PMP directs the overall project planning function and defines the organization, resources, and methodology for meeting customer requirements.

The CLASS QMP supplements the PMP and documents the quality management function. The QMP was developed in accordance with the following documents:

- CLASS Master Project Management Plan (PMP), August 2002
- CLASS OSDPD Activity Plan (AP), October 2002
- CLASS Configuration Management Plan (CMP), October 2002

1.5 Document Maintenance

The QMP has been reviewed and approved by the CLASS Project Management Team (CPMT) and is under baseline control. During the course of the CLASS project, the QM organization will continually make improvements to its internal processes. In this way, the QM organization remains efficient and responsive to the customer and project quality needs and requirements. Any changes to this QMP will be submitted to the QM manager and then to the CLASS Project Management Team (CPMT) for authorization and approval.

Section 2 - Quality Management Responsibilities

This section identifies the QM responsibilities and relationships at all levels of the CLASS project, and describes the QM responsibilities of CLASS project management and technical personnel.

2.1 Quality Management Organization

The basic tenet for Quality Management is to make all employees responsible for the quality of their work. As implemented on the CLASS project, this means that quality management is the responsibility not only of management, but also of all project personnel who perform work for, and provide services and products to NOAA.

The Quality Management Office (QMO) is responsible for monitoring the implementation of quality management throughout the project and supporting all levels of project management. The QMO reviews formal project deliverables and monitors project activities for compliance with CLASS policies, and with methods, processes and associated standards and procedures. The QMO is independent of the CLASS project management organization. The QM Manager coordinates ongoing support activities with CLASS management, but reports administratively to the Director of Quality Management (DQM). The QM manager is assigned to the CLASS Project by their mutual agreement. Issues identified by the QMO that cannot be resolved by the CPMT are escalated to the NESDIS CIO or to the Director of Quality Management. This relationship is depicted in Figure 2-1, Quality Management Relationships.

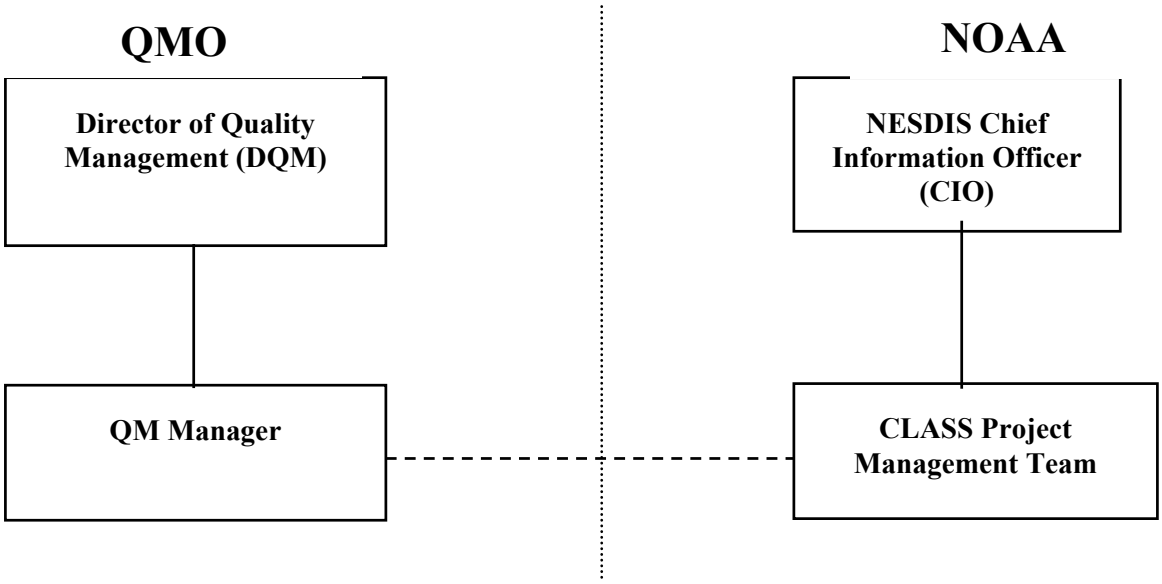

Figure 2-1. Quality Management Relationships

The primary functions of the CLASS QMO are:

- Maintain awareness of the project product and service quality
- Provide management with the visibility of the processes used in project performance
- Notify the appropriate manager or the CPMT in a timely manner about existing or potential quality-related problems
- Develop and implement a quality program to ensure the project's system, products, and services meet requirements
- Make recommendations regarding policies, methodology, processes, procedures, and standards
- Develop supplemental quality management procedures and standards, as needed
- Administer a quality-focused problem management process, including monitoring and reporting on the problem resolution process
- Plan, conduct, and monitor the performance of activities in accordance with both the Master Project Management Plan (PMP), the team activity plans (APs) and this Quality Management Plan (QMP)
- Review all project deliverables
- Conduct project process audits
- Assist the appropriate manager in planning and, if necessary, interpreting requirements and applying guidance and associated standards and procedures
- Provide project staff with orientation and training in quality management responsibilities and processes
- Monitor project activities for compliance with policies, processes and procedures, guidance for business solution activities, and guidance for software development activities that are defined in support of specific tasking

The QMO supports the implementation and related training for the Quality management program as defined by this QMP.

The QMO is responsible for monitoring implementation of the quality program throughout the project and supports all levels of management. The QM Manager supports the implementation and related training of CLASS personnel in basic QM processes, including system development and maintenance methodologies, related standards and procedures, inspections and reviews, and auditing. QMO monitors project activities to ensure compliance with the policies reflected in this QMP and the related standards and procedures (S&Ps) throughout all system phases and maintenance activities.

The QM Manager supports the CLASS Project Management Team (CPMT) in defining and overseeing implementation of the QM program. Responsibilities in this capacity include:

- Develop and maintain the project QMP

- Ensure that the QMP addresses the quality goals and priorities of the project and client organization, and satisfies all organization requirements and expectations
- Ensure that the QMP is put under configuration management (CM) control and made available to all affected groups and individuals
- Ensure audits of activities for compliance with the QMP and other applicable requirements
- Establish processes and procedures to perform QM activities
- Report findings to CLASS project and QMO management, and identify corrective actions related to the product and process verifications.

2.2. Quality Management Responsibilities of Others

This subsection describes the quality-related responsibilities allocated to all CLASS personnel. Both the QM Manager and the CLASS project personnel perform quality functions. Appendix B, Distribution of Quality Responsibilities, reflects the distribution of effort between the QMO and CLASS project personnel.

2.2.1 CLASS Project Management Team (CPMT)

The CLASS Project Management Team (CPMT) is responsible for providing direction in implementation of the QM program defined by this QMP and for ensuring that adequate resources are allocated to accomplish the implementation. The project management team is responsible for meeting the quality goals and objectives of the project and for the implementation of quality management throughout the project.

2.2.2 Technical Area Leads

The Technical Area Leads (TAL), or management designee, interface with the QM Manager regularly to review the status of quality activities and to address any related issues identified by the QMO. TALs are responsible for establishing quality goals and objectives for their organization that are consistent with those of the project.

2.2.3 Lead Integrator

The Lead Integrator (LI) is responsible for integration testing. The LI develops project plans and reports for systems integration and test activities, defines requirements for, develops, and implements test plans for systems integration.

2.2.4 Software Engineering Process Group (SEPG)

The focus of the Software Engineering Process Group (SEPG) is to conduct and ensure quality-related intergroup coordination throughout CLASS. The members of the SEPG are responsible for identifying the processes and corresponding standards and procedures (S&Ps) to guide project performance. They are further responsible for ensuring that work activities are performed in compliance with these processes and S&Ps.

2.2.5 Project Technical Staff

Technical personnel play a major role in implementing the CLASS QM program. It is their responsibility to build quality into the products they develop or support. It is also their responsibility to propose process improvements based on their application of the methodology.

Technical personnel may be matrixed to the QMO to perform QM activities. During their performance of these activities, they report activity status and discrepancies to the QM manager on an event driven basis. The QM manager periodically reviews the resulting reports of these activities.

Technical personnel are also participants in the inspection and certification (I&C) and review processes applied to intermediate products resulting from project work activities. Serving as inspectors or reviewers, they examine the products of their peers to ensure technical soundness and overall quality before proceeding to the next phase of development.

Another significant QM-related responsibility is the performance of independent testing. All systems developed or modified under the Program must be adequately tested before they are delivered or made available for use. Personnel familiar with the products being validated, but not the developer of that product, typically perform testing. The tests ensure that new and revised systems meet allocated requirements as well as establish their overall quality and delivery readiness.

Section 3 - Quality Management Approach

The QMO monitors the system development and maintenance processes and the products of those processes for conformance with the agreed upon standards and procedures.

3.1 Key Quality Management Concepts

This QMP is designed to be compliant with the project's contractual requirements. The CLASS PMP, CMP, other project-related documents, and industry best practices provided much of the information needed for preparation of this plan. The CLASS quality program defined in this plan is based on the following key concepts:

- The program is an active, rather than passive, endeavor. Implementation of, and compliance with, it is the shared responsibility of all personnel; both management and the technical staff are fully committed to the success of the program.
- The program is administered by QMO, organizationally independent of the CLASS Project, to ensure full objectivity in assessing and reporting all quality-related aspects of CLASS performance.
- The program fully supports the objectives and goals of the CLASS project management and process improvement initiatives.
- Quality is designed early into products using defined processes and procedures, which are monitored and updated to improve their efficiency, to prevent problems before they occur, and to maintain the desired quality of resulting products.
- The methods used for analysis, design, implementation, and testing activities during system development and maintenance result in intermediate products that can be reviewed and/or tested for correctness and compliance with applicable S&Ps as a basis for assessing quality and measuring work progress through the system life cycle.

CLASS quality management activities are reviewed regularly with the CPMT to enable early modification and revision of work products in recognition of changes and improved or new processes and technologies.

3.2 Overview of Quality Management Methods and Activities

The QMO develops and maintains procedures for performing quality activities. Standards and procedures to meet needs related to unique activities or to customer requirements will be created. The specific standards and procedures to be followed are determined during the planning process and constitute the basis for the QMO to monitor and assess work products and processes for compliance.

Integral to the Quality Management program are the activities implemented to monitor the processes and products of CLASS for compliance with requirements. Quality activities are planned and monitored through the use of a Quality Activity Schedule (QAS). The QAS reflects the planned and actual dates for work product (WP) reviews and specific quality audits and activities. The planned dates reflected in the QAS are based on agreements after consultation

with the CLASS Technical Area Leads. Table 3-1 depicts the form that is used to document, plan, and track quality activities. Dates for planning and conducting quality management activities will correspond to each key activity in the project schedule. A project quality activity schedule is completed by the QMO.

Table 3-1. Quality Activity Schedule Form

Item	Item Complete	Peer Review	QM Review	Comments
WP1	<plan>	<plan>	<plan>	
	<actual>	<actual>	<actual>	
WP2				
WP3				
Item	**Item Complete**	**Actions Resolved**	**Comments**	
Quality Planning & Coordination	<plan>			
	<actual>			
QMO Orientation Training				
IPPA				
LCPA				
Audit 1				
Audit 2				
Lessons Learned				

During planning for the project, the QM Manager interfaces with the appropriate manager to ensure adequate planning for quality activities leading to successful fulfillment of the Project's requirements and goals. Using the Quality Activity Schedule form, the QM Manager documents the schedule for performing the quality activities. The QM Manager also ensures that:

- Process tailoring is appropriately addressed and documented
- Approved procedures and standards for performing activities are in place
- Training needs for the activities are considered and addressed
- Artifacts for the planned activities are understood and a structured repository is in place for archival
- Quality goals are defined and documented

- Measurement data is identified for subsequent collection and analysis
- Defect prevention initiatives are incorporated into planned activities

This subsection describes the following features of the CLASS QM program:

- Standards and Procedures (S&Ps)
- Process Assurance Cycle (PAC)
- Work planning
- Peer reviews
- Process and product audits
- Tracking and reporting
- Formal Testing
- Configuration management
- Non-conformance reporting and corrective action
- Training

The QM activities related to each of these features are described in the following subsections of this section. Industry experience shows that consistent performance of those activities will result in high-quality system development processes and therefore in high-quality products.

3.2.1 Standards and Procedures (S&Ps)

The application of a methodology in a consistent manner is facilitated by the use of documented technical services S&Ps, to ensure a common approach to performance of the work processes. The specific S&Ps to be followed by an activity are determined during the planning process. The S&Ps specified for each activity constitute the basis for QMO monitoring and assessment of project performance.

3.2.2 Process Assurance Cycle

The Process Assurance Cycle (PAC) is a process that will promote consistent application and use of approved processes across the project. It includes mechanisms that support accomplishment of basic QM-related activities:

- Identify and document the specific development approach to be followed in performing system development or enhancement activities,
- Facilitate project team understanding of the approach and the process by which it is to be implemented,
- Verify compliance with the approach throughout project performance, and
- Report and monitor action items to address problems identified by the QMO in accomplishing the PAC process.

The PAC process consists of five major activities or milestones. These activities are jointly planned between the CLASS Technical Area Lead (TAL), or management designee, and the QM Manager. The implementation of the PAC is the responsibility of the QM Manager.

- Documentation of the Development Approach - the QM Manager interfaces with the TAL to ensure adequate planning for quality activities leading to the successful fulfillment of the Project's requirements and goals. The activities include a definition of baseline development processes to be followed in terms of specific methodology guidance, related S&Ps for each life-cycle phase, and identification of metrics to be collected. This information will feed to and through the SEPG for guidance, recommendation for approval, and dissemination to CLASS personnel for implementation.
- Pre-phase Process Review - a detailed review of the identified development approach before beginning each life-cycle phase to identify any needed updates, reassessment of staff skills and planned training, and review of any S&Ps to be developed. The purpose of the pre-phase process review is to provide assurance that the processes, including standards and procedures, needed for executing the planned activities for a project phase are in place and are compliant with CLASS requirements. This process evaluation ensures that the processes are documented, the required artifacts are identified, and the processes are verifiable. The process evaluation also identifies needed or missing procedures or standards, providing the opportunity to bring identified process gaps to the attention of the TALs so that associated issues may be rectified prior to process execution.
- During process evaluation, the QM Manager reviews the planned project activities as documented in the Project Management Plan and the project's tailoring plan (where applicable). The QM Manager ensures that processes are documented for the execution of the planned activities, verifiable artifacts are identified for the planned activities, and that any gaps in the documented process approach are identified and resolved. The QM Manager also ensures that a mechanism is in place for recovery of artifacts for subsequent verification.
- Phase Orientation Meeting - a project team review of planned activities, S&Ps and project processes to be applied, metrics to be collected, team member roles and responsibilities, and training status at the beginning of each life cycle phase
- In Progress Process Audit (IPPA)- an assessment early in a life cycle phase to verify that activities are being performed, designated products are being developed, and specified S&Ps are being followed as basis for timely initiation of any corrective actions needed
- Life Cycle Phase Audit (LCPA) - an audit at completion of each life cycle phase to verify applicable activities and products are completed, metrics are collected and archived, relevant action items are resolved, discrepancies are documented, and lessons learned are captured.

3.2.3 Work Planning

To facilitate work planning, QMO personnel supporting the activity review the work statement and requirements and jointly estimate the needed QMO resources with the appropriate manager.

3.2.4 Product Reviews

Product reviews are conducted at intermediate and final stages of the project life cycle to evaluate compliance of work products with processes and standards, and to evaluate how well the technical approach meets contractual commitments. Product reviews include peer reviews and QMO deliverable reviews.

3.2.4.1 Peer Reviews

Intermediate products generated in the development life-cycle phases are examined by peers of the author/developer not only as a means to ensure the technical validity and quality of the final product, but also as a basis for reporting of work progress. The result is a quantitative and auditable measurement of status throughout the development process that is directly linked to quality. These reviews take the form of walkthroughs, inspections, and document reviews. Inspections are monitored periodically by the QMO to assure the process is conducted in accordance with applicable S&Ps and that necessary metrics are collected.

Formal documents prepared under the CLASS Project are subject to internal technical and quality reviews. Although the scope of a document review varies with its phase of production (i.e., draft, final, update), it consists of a detailed critique of technical accuracy and completeness by knowledgeable technical personnel and a quality examination by the assigned QMO staff for compliance with applicable guidance and standards. The QMO staff also performs detailed reviews of baseline documents to ensure that approved change requests have been incorporated properly and that unauthorized changes are not included.

3.2.4.2 QMO Deliverable Reviews

Deliverables are reviewed by the QM Manager for adherence to project requirements and applicable standards. If the QM Manager considers the deliverable deficient, it should be revised and resubmitted to quality review. If serious deficiencies are not corrected, the QM Manager will withhold his or her signature on the deliverable. Project management makes the final decision on delivery of work products, with or without the QM Manager's signature.

3.2.5 Process Audits

The CLASS Project audit program applies to both management and technical activities and emphasizes verification of compliance with approved processes and supporting procedures and guidance. System development and maintenance activities are audited throughout their duration to ensure that the work approach is implemented as planned and that processes are consistent with the approach as well as with the methodology and S&Ps designated for performance. Audits are conducted on a planned basis, with some scheduled periodically and others performed as a function of defined milestones.

The QMO develops audit plans and schedules for supported projects in coordination with the TALs, or management designee. Specific types of system audits conducted under CLASS include the following:

- In-Progress Process Audit (IPPA)- audit to verify planned activities are being performed, designated products are being developed, and designated S&Ps are being followed (part of PAC process). At an intermediate point in each phase, the QMO conducts an IPPA and reports the finding to project management (CPMT).
- Life-Cycle Phase Audit (LCPA) - process audit conducted at completion of each life-cycle phase to verify needed activities and products are completed or accounted for and related action items are resolved (part of PAC process), discrepancies are documented, and lessons learned are captured. At or near the completion of each phase, the QMO conducts an LCPA and reports the findings to project management (CPMT).
- Build/Release Audit - audit as to whether all work related to a build/release has been properly completed.
- Functional Configuration Audit - formal review of a completed or as-built configuration item (CI) to verify it meets all allocated requirements. This audit is further discussed in the CLASS Configuration Management Plan (CMP).
- Physical Configuration Audit - formal review of a completed or as-built CI to verify conformance with its technical documentation and the absence of unauthorized changes. This audit is further discussed in the CLASS Configuration Management Plan (CMP).
- Lessons Learned – lessons learned activities are performed by projects and functional areas to identify best practices and potential improvements to products and processes. Lessons learned are captured in a lessons learned report. The QMO reviews the lessons learned report with project management, and ensures implementation and distribution of the recommended improvements throughout the project. The QMO may also prepare a lessons learned report subsequent to a single process audit or product review, or a series of process audits or product reviews.

A final report is issued for each audit completed and identifies any deficiencies found as well as action items to address other issues observed in the audit. Results of every audit are reviewed with appropriate project management. Managers responsible for the activities audited review these reports and take the necessary actions to resolve any deficiencies and action items that require follow-up, including re-audits when necessary.

QMO audits processes at the project level for compliance with applicable policies and direction. QMO also periodically audits the configuration management (CM) function at the project and activity levels for compliance with applicable directives and S&Ps. Status accounting reports are checked against configuration control board records, and status records are reviewed for completeness and accuracy.

The TAL or other manager may request audits of any aspect of system development efforts not covered above on an ad hoc basis. In such instances, the requester identifies the scope and objective of the audit and may designate an audit leader. The audit leader then establishes guidelines for the audit and nominates the candidate audit team, subject to concurrence of

appropriate management. The QMO is typically involved in these audits, assisting in development of the audit plan and guidelines for conduct, participating as a team member, and helping to prepare the audit report.

3.2.6 Monitoring and Reporting

Throughout the conduct of CLASS activities, the QMO monitors ongoing activity performance to maintain an awareness of compliance with planned project processes and the use of applicable S&Ps as well as cognizance of the work practices employed by the team. This insight facilitates the QMO role as an advisor to all levels of management within CLASS, from a team lead to project management, providing independent and unbiased assessments. In written or verbal form, QMO reports of findings and observations include those with both positive and negative implications to ensure that management has a complete and impartial perspective on which to base their actions. The QM manager regularly meets with the CPMT to discuss these observations and to provide any recommendations for improvement.

3.2.7 Formal Testing

The QMO monitors system integration and testing activities throughout system-level testing. Before this activity begins, QM staff verifies that test plans and procedures are adequate, conform to applicable standards, and have been reviewed by technical personnel. During testing, QM staff may witness tests performed to ensure that approved procedures are followed, changes to procedures needed during test execution are red-lined, and test results are accurately and completely recorded. QM staff also verifies that the use of test data is as described in the test plan, and that the test results conform to their description in the test procedure. In addition, QM staff ensures that output anomalies or deviations resulting from execution of the test procedures and that problems identified during testing are formally recorded for subsequent review and resolution.

3.2.8 Configuration Management

The planning of CLASS activities encompassing system development and enhancement activities includes identification of the CM approach to be used and change control procedures to be followed. This guidance, reviewed by the QMO, ensures that system software and hardware elements being developed or revised are baselined and placed under configuration control at the appropriate milestones and that testing is performed on controlled versions of the elements.

A major function of CM is to maintain configuration change request records, including the impact(s) of the change, the disposition of the request, and the implementation schedule and status for approved requests. Periodic audits of these records by QM staff include review of the configuration control process to ensure it is functioning as required and that each baseline contains only what has been approved.

Configuration Management is further defined and discussed in the CLASS Configuration Management Plan (CMP).

3.2.9 Non-Conformance Reporting and Corrective Action

The non-conformance reporting and corrective action system complements corresponding programs in place across CLASS organizations. Specific forms and procedures are used to document system problems or anomalies detected in products after they are placed under baseline control.

QMO monitors activities under the CLASS non-conformance program, especially those involving the recording, resolution, and status reporting of anomalies and problems. The QMO monitors these non-conformances, reviews the resolution priority, verifies reports of the outstanding non-conformances, and tracks the status of each until resolution is verified.

Action Requests (AR) are documents generated to resolve significant quality issues found by the QM Manager, or other personnel, through audits and reviews. The quality issues and resultant actions are documented in ARs. The AR documents problems or nonconformances from contract requirements and other process standards. The QMO issues the AR to the manager who can effect a correction. The manager has ten working days to respond and identify activities to remedy the root cause of the problem.

A copy of the AR is kept in the QMO files. The QMO validates the nonconformance, reviews the resolution priority of the AR, verifies reports of the outstanding nonconformance, and tracks the status of each AR until resolution is verified. AR reports are used to identify quality issues to project management. They are also used to identify negative trends in performance or specific areas for improvement. If a problem or deficiency is not corrected at the lower levels of responsibility, the QMO escalates the issue until it is resolved. These issues are escalated appropriately as follows:

- CPMT
- NESDIS CIO
- Director of Quality Management (for assistance in resolving the issue)

3.2.10 Training

In addition to providing instruction in QM processes and supporting tools, the QMO is responsible for developing and presenting courses specific to the implementation of the CLASS QM program. QMO personnel may also serve as facilitators or instructors for workshops and seminars in various software development or process-related topics.

Additionally, QMO conducts the PAC-related phase orientation meeting to ensure common understanding of the work planned and the manner in which it is to be performed. As part of the PAC process, the QMO may identify specific training needs for a group while assisting in generating the PAC development approach and conducting in-progress process audits with respect to the training and skills appropriate for personnel.

3.3 Quality Measurement

The QMO assists management and technical staff in collecting and reviewing metrics data. When trends that adversely affect the quality of project products are detected, the related

processes are targeted for improvement and appropriate initiatives to effect such improvements are defined, implemented, and evaluated. In addition, managers may identify metrics specific to their environment. In these instances, the QM staff assists in the collection and review of such data as a further basis for monitoring quality and identifying possible improvements.

3.3.1 Software Quality Goals

Production, operations, and system performance goals shall be in accordance with requirement minimums. Other goals and metrics may be added as necessary to monitor progress and quality. The establishment of process and quality goals should be based upon local historical or industry standards.

3.3.2 QMO Orientation Training

At the start of project phase activities, the QM Manager conducts a QMO Orientation Training meeting to communicate planned quality activities and goals to all members of the project team.

At the QMO Orientation Training, the QM Manager presents the quality activity schedule. For each planned quality activity, the QM Manager discusses applicable standards for the products produced, documented procedures for conducting activities, and the artifacts produced for the activities. The location of the standards and procedures is provided, and the procedure for archiving project artifacts is described.

Defect prevention initiatives are discussed in the context of process improvements incorporated for the project phase. Quality goals are presented with a description of measurement data that will be collected and analyzed.

3.3.3 Measurement and Analysis

All organizational elements are involved in the measurement program that provides a systematic approach for defining, collecting, archiving, analyzing, and reporting project metrics. Metrics are collected and analyzed against the software quality goals. Periodically, the QM Manager reviews the metrics with TALs. If thresholds are exceeded, necessary corrective action will be implemented. Other metrics collected will be analyzed to evaluate internal performance and identify areas to improve effectiveness.

The QMO is responsible for defining, tracking, and reporting project-level quality metrics. Quality measurement data and trends are included in project status reports, presented to project management (CPMT), and stored in QMO repositories. Quality measurement data is collected to support the project measurement activities. Analysis of quality measurement data is used to evaluate and improve the overall performance of the CLASS project activities. Table 3-2 describes the quality metrics monitored on the CLASS project.

Table 3-2. Quality Metrics

Metric	Description	Source	Frequency
Deliverable status	Late vs. on time Accepted vs. rejected	Deliverables repository	Monthly
Process assessment status	Planned vs. completed ARs written, awaiting response, closed, past due	Quality Activity Schedule and Status Report	Monthly
Product review status	Planned vs. completed Number of defects by type	Quality Activity Schedule Product Review Artifacts	Monthly

Section 4 - CLASS Quality Management Records and Reports

CLASS Quality Management personnel complete and/or maintain various records and reports in the conduct of their work, as discussed in this section.

4.1 Project File Records

For each activity, Quality Management personnel maintain data and information related to their activities. These include: schedule of anticipated QM, QM metrics, audit support materials such as audit plans, checklists, evidentiary materials gathered during the audits, and copies of audit reports. Other items, such as CM records and peer review records, are reviewed for availability and completeness.

4.2 Monthly Status Reports

The QM manager prepares a Monthly CLASS QM status report that is distributed to the CPMT and the CIV Director of Quality Management. The report highlights significant QM activities performed and milestones achieved at the project level as well as identifying issues and concerns that require, or may potentially require, action at the project and/or group level.

4.3 Audit Reports

For each of the various types of audits performed by the QMO, the QM personnel conducting the audit prepare a report that is distributed to management and other personnel in accordance with the related audit procedure. Reports of audits are provided to the CIV Director of Quality Management. Audit reports are of two types, general and PAC-related, as discussed below.

4.3.1 General Audit Reports

General audits are performed on a scheduled or an ad hoc basis as proposed in the Process Audits section of this Plan, and are conducted in accordance with documented CLASS project procedures, which identify the required content and distribution of audit reports. Prepared by the QMO following completion of the described audit, the audit reports typically include the following information:

- Purpose and description of the audit
- Identification of audit team members, the interviewees, and the items reviewed
- Results of the audit (findings, observations, and recommended process improvements)
- Corrective Action Requests resulting from the audit
- Needed audit follow-up activities (e.g., a corrective action plan, a revisit of the audit in 30 or 90 days to verify that appropriate corrective actions have been taken).

4.3.2 PAC Reports

The PAC process provides for formal reporting of the findings obtained in conducting each of the two types of audits included within the process. The PAC reports will consist of a summary report for the appropriate audit and may also produce an Action Request (AR). Two types of Action Requests may be produced, a Correction Action Request (CAR) that identifies a non-conformance, or a Preventive Action Request (PAR) that identifies a process improvement.

4.3.2.1 In Progress Process Reports

QM personnel use the project's development approach information (the list of processes to be used by the project) as a checklist/benchmark for the IPPA audit and the IPPA audit report. On the report, they note compliance or non-compliance with each process, and then complete the Summary Findings portion of the report, defining any related recommendations. Any Action Requests identified during the audit are identified on the checklist together with the name of the person assigned responsibility for the action and the expected completion date. The ARs are then tracked through closure via the QMO Audit database.

4.3.2.2 Life Cycle Process Reports

QM personnel again use development approach information as the checklist/benchmark for the LCPA audit and the LCPA audit report. They attach additional sheets defining observations and/or discrepancies detected a summary of the audit findings, recommendations for process improvement, and actions required for closing out the audit. Action Requests are identified, including the name of the person assigned responsibility for implementation of the action request, and the expected completion date. ARs are then tracked through closure via the QMO Audit Database.

Appendix A - QM Schedule and Metrics

Table A-1, Quality Management Schedule of Activities, provides a template for planned quality activities and the basis for the information collected for the QM Metrics Report. The scheduled activities and metrics will be updated and maintained by the QMO with a copy contained in the CLASS QM repository.

Table A-1. Quality Management Schedule of Activities

Activity	Planned Date	Responsible Party
Update QMP (this document)	Yearly or Contractually	QMO
Attend reviews and status meetings	As scheduled	All Personnel
Review of turnover packages	Release driven	CMO
Review Quality Metrics	Monthly	QMO, CPMT
Scheduled Documents Review	As scheduled	Peers and QMO
Review Risk Assessment	Quarterly	QMO, CPMT
Audit system acceptance test baseline	Release driven	CMO
In Progress Process Audit (IPPA)	Event driven	QMO
End of Performance Period Audit (EPPA)	Event driven	QMO
Functional Configuration Audit (FCA)	Release driven	CMO
Physical Configuration Audit (PCA)	Release driven	CMO
Build/Release Audit	Release driven	CMO
Lessons Learned	Event driven	QMO, CPMT

Appendix B – Distribution of Quality Responsibilities

Table B-1 reflects the distribution of quality effort between the QMO and CLASS project personnel. Identified in the table are the quality function and the level of responsibility of each presented organization. The responsibility for each activity is identified as:

- A – Approves
- L – Leads
- P – Participates
- R – Reviews

Table B-1. Distribution of Quality Responsibilities

Activity **Legend: A - approves, L - leads, P - participates, R – reviews** *** - denotes special circumstance**	QMO	CPMT	TAL	LI	Staff	SET	SEPG	Other

Appendix C – Glossary

In the context of this plan, the following terms have the meanings specified:

Acceptance - Official recognition that a product (usually hardware or software CI) meets contractual and project requirements.

Approval – Official recognition of product validity.

Baseline – Work products (e.g., document and/or software) that have been officially approved or accepted and used to judge the acceptability of a system, subsystem, or CI. (A baseline is subject to configuration control and is updated to reflect approved changes to the CI throughout its life cycle.)

Build - Intermediate version of a system or CI that provides a demonstrable subset of capabilities needed to meet requirements allocated to the system or CI. Subsequent builds also meet (the requirements met by a build.)

Configuration - Form, fit, and functions of a system or CI as defined in baseline documentation.

Configuration Item (CI) - Developed or purchased item, controlled, accepted, and maintained separately from other items. (A CI can be composed of hardware or software or, for major CIs, an aggregation of both.)

Configuration Management (CM) - Discipline that involves identifying, controlling, and tracking the configuration of a system or product.

Corrective Action – Corrective action is taken to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent recurrence.

Deliverable – A work product or service given to the client for review and acceptance. It frequently has contractual implications.

Inspection - Evaluation technique in which intermediate development products are examined in detail by a person or group other than the author to detect technical deficiencies or violations of standards.

IPPA – An In Progress Process Assessment determines whether planned activities are being performed, designated products are being developed, and specified standards and procedures are being followed. At an intermediate point in each life cycle phase, the QMO conducts an IPPA and reports findings to project management.

LCPA – A Life Cycle Phase Assessment is conducted to verify applicable activities and products are completed, metrics are collected, relevant action items are resolved, discrepancies are documented, and lessons learned are captured. At or near the completion of each life cycle phase, the QMO conducts an LCPA and reports findings to project management.

Lessons Learned – Lessons learned are guidance that enhance the practitioner's understanding of a process, clarify a process' applicability to a particular engagement category or domain, provide guidance for special cases, highlight issues, or convey vendor advice. The lessons learned come from a variety of sources including, but not limited to, engagement experience,

experiences in laboratory trials of tools and techniques, and published best practices from other organizations.

Measure – A measure is any quantitative group. Examples of measures are estimated cost, actual cost, ratio of actual to estimated cost, number of defects, defect density, mean time between failures, average length of support call, and number of peer reviews performed.

Measurement data – Data made up of value instances of measures.

Peer Review – An examination of a product by the creators' peers to identify defects and areas where changes are needed. It uses the capabilities of independent reviewers, individually or in a group, to identify the improvements needed in a product and to agree on which improvements should be made.

Preventive Action – Preventive action is action taken to eliminate the causes of a potential nonconformity, defect, or other undesirable situation in order to prevent occurrence.

Process Audit – A formal review of a process implementation against a documented standard or process. A process audit is a planned activity that focuses on a project or a functional area.

Product Review – An examination of a product to identify errors before the product is formally passed forward in the development process.

Quality - Degree to which a system or CI satisfies its requirements.

Quality Management – Consists of the management responsibilities and actions that determine and implement quality policies. It includes obtaining the commitment of the organization, marshaling resources, and ensuring that quality management processes are used and supported effectively.

Release – A build that will be delivered to the customer. A release may include an integrated set of builds.

Test - Sequence of events designed to verify that a system or CI satisfies requirements or to identify differences between expected and actual results.

Unit – Smallest replaceable element in a CI also referred to as a configuration unit (CU). For software, a unit is typically a subroutine; for hardware, a unit may be a board that is fabricated as a separate item.

Appendix D - Acronyms

AP	Activity Plan
AR	Action Request
CAR	Corrective Action Request
CCB	Configuration Control Board
CIV	Civil Group
CLASS	Comprehensive Large Array-data Stewardship System
CM	Configuration Management
CMP	Configuration Management Plan
CPMT	CLASS Project Management Team
CR	Change Request
CSC	Computer Sciences Corporation
CSDPC	[NOAA] Central Satellite Data Processing Center project
DQM	Director of Quality Management
EPPA	End of Performance Period Audit
FCA	Functional Configuration Audit
I&C	Inspection and Certification
IPPA	In-Progress Process Audit
LI	Lead Integrator
NESDIS	National Environmental Satellite Data and Information Service
NOAA	National Oceanic and Atmospheric Administration
PAC	Process Assurance Cycle
PAR	Preventive Action Request
PCA	Physical Configuration Audit
PMP	Project Management Plan
QM	Quality Management
QMP	Quality Management Plan
QMO	Quality Management Office
S&Ps	Standards and Procedures
SEI CMM	Software Engineering Institute, Capability Maturity Model

SEPG	Software Engineering Process Group
TAL	Technical Area Leads
WP	Work Product